UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

1a. REPORT SECURITY CLASSIFICATION Unclassified	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION / AVAILABILITY OF REPORT APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED
2b. DECLASSIFICATION / DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) CRM 87-93	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION Center for Naval Analyses 6b. OFFICE SYMBOL (*If applicable*) CNA	7a. NAME OF MONITORING ORGANIZATION Office of Chief of Naval Operations (OP-01)
6c. ADDRESS (*City, State, and ZIP Code*) 4401 Ford Avenue Alexandria, Virginia 22302-0268	7b. ADDRESS (*City, State, and ZIP Code*) Navy Department Washington, D.C. 20350-2000
8a. NAME OF FUNDING / SPONSORING ORGANIZATION Office of Naval Research 8b. OFFICE SYMBOL (*If applicable*) ONR	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER N00014-87-C-0001
8c. ADDRESS (*City, State, and ZIP Code*) 800 North Quincy Street Arlington, Virginia 22217	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. Navy PROJECT NO. 65154N TASK NO. R0148 WORK UNIT ACCESSION NO.
11. TITLE (*Include Security Classification*) Total Force Enlistment Programs Simulation, Volume I	
12. PERSONAL AUTHOR(S) Timothy W. Cooke	
13a. TYPE OF REPORT Final 13b. TIME COVERED FROM _____ TO _____	14. DATE OF REPORT (*Year, Month, Day*) June 1987 15. PAGE COUNT 39
16. SUPPLEMENTARY NOTATION	
17. COSATI CODES FIELD / GROUP / SUB-GROUP	18. SUBJECT TERMS (*Continue on reverse if necessary and identify by block number*)

19. ABSTRACT (*Continue on reverse if necessary and identify by block number*)

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20. DISTRIBUTION / AVAILABILITY OF ABSTRACT ☐ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION Unclassified
22a. NAME OF RESPONSIBLE INDIVIDUAL	22b. TELEPHONE (*Include Area Code*) / 22c. OFFICE SYMBOL

DD Form 1473, JUN 86 *Previous editions are obsolete.*

SECURITY CLASSIFICATION OF THIS PAGE
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CNA CENTER FOR NAVAL ANALYSES
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24 August 1987

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Subj: Center for Naval Analyses Research Memorandum 87-93

Encl: (1) CNA Research Memorandum 87-93, "Total Force Enlistment Programs Simulation, Vol I," Jun 1987

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2. The Total Force Enlistment Programs simulation is based on continuation and affiliation behavior of individuals in six enlistment programs as observed in recent years. Total accessions and their distribution among enlistment programs and ratings are inputs to the simulation. The effects of changing these inputs are simulated by comparing the future inventories associated with alternative accession profiles.

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CRM 87-93 / June 1987

TOTAL FORCE ENLISTMENT PROGRAMS SIMULATION

Volume I

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This research memorandum, CRM 87-93 (Vol. I), describes the structure and development of the Total Force Enlistment Program Simulation. The simulation analyzes changes in inventories of enlisted active-duty and reserve personnel associated with changes in the number of active-duty accessions and their distribution among enlistment programs. The simulation is based on continuation and affiliation behavior of individuals in six enlistment programs as observed in recent years. Total accessions and their distribution among enlistment programs and ratings are inputs to the simulation. The effects of changing these inputs are simulated by comparing the future inventories associated with two different accession profiles. CRM 87-94 (Vol. II) contains technical appendixes that supplement the descriptions in this paper.

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INTRODUCTION

This research memorandum describes the structure and development of a computer simulation that analyzes changes in inventories of enlisted active-duty and reserve personnel associated with changes in the number of active-duty accessions and their distribution among enlistment programs. The simulation provides the first analytical capability that addresses the total force (active and reserve) nature of the enlisted accession-program mix. A total force perspective is necessary because, for example, each recruit in the Active Mariner (AM) accession program has an obligation to serve three years in active duty and three years in Selected Reserve (SELRES) duty. AM accessions have recently numbered about one out of every six regular Navy accessions. In addition, changing the number and mix of active-duty accessions alters the number of Navy veterans who may affiliate with the SELRES.

The simulation is designed to accommodate any combination of accessions into 5 active-duty enlistment programs and 69 rating groups. It can handle accession-program combinations that have not been observed, if the analyst is willing to make assumptions about active-duty continuation and SELRES affiliation rates. This has been the procedure followed in the analysis of the Navy Sea College Program that had its first accessions in FY 1987. Otherwise, the simulation uses historical behavior to approximate future behavior. There are no provisions made for future retention behavior to respond to changes in the economy or Navy policy actions that affect continuation behavior. A choice of past continuation rates representing observed behavior at various times since 1980 can be made available to the analyst to provide some plausible variation in uncertain future continuation behavior.[1]

The simulation has evolved in response to analytical requirements and data constraints, with each new version representing an improvement. It is reasonable to expect that, with sufficient interest on the part of Navy accession planners, this evolution will continue.

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1. The fact that the simulation is historical rather than behavioral is of some concern because shortages and surpluses predicted with historical simulations tend to engender adaptive behavior that mollifies the observed shortage or surplus. Thus, the results may best be interpreted as what would be expected to happen if no adaptive policies were to be implemented. Also, the effects of unforeseen changes in the economy may lead to systematically incorrect predictions regarding average continuation behavior. Relative continuation differences between enlistment programs are not expected to be as volatile.

OUTLINE OF SIMULATION METHODOLOGY

The forecast of next year's enlisted inventory is based on the current year's inventory (of which about 15 percent is new accessions), and observed historical continuation behavior that dictates how the current inventory ages from one year to the next. The portion of each year's inventory that represents new accessions is the primary focus of interest. The analyst must supply the number of accessions and their distribution across 6 enlistment programs and 69 rating groups. The number and distribution of individuals already in the inventory is predetermined by past accession decisions and continuation behavior.

Figure 1 illustrates the flow of simulation for each combination of original enlistment program, rating group, and length of service (LOS). Implementing this simulation design presents several measurement and forecasting problems that necessitate minor changes to figure 1. The most important is lateral continuation behavior involving changes in rating, with the associated potential for simple continuation rates to exceed 1.0. The following sections discuss each of the flows in figure 1 as they have been implemented in the simulation. The simulation software and major data elements are presented in [1].

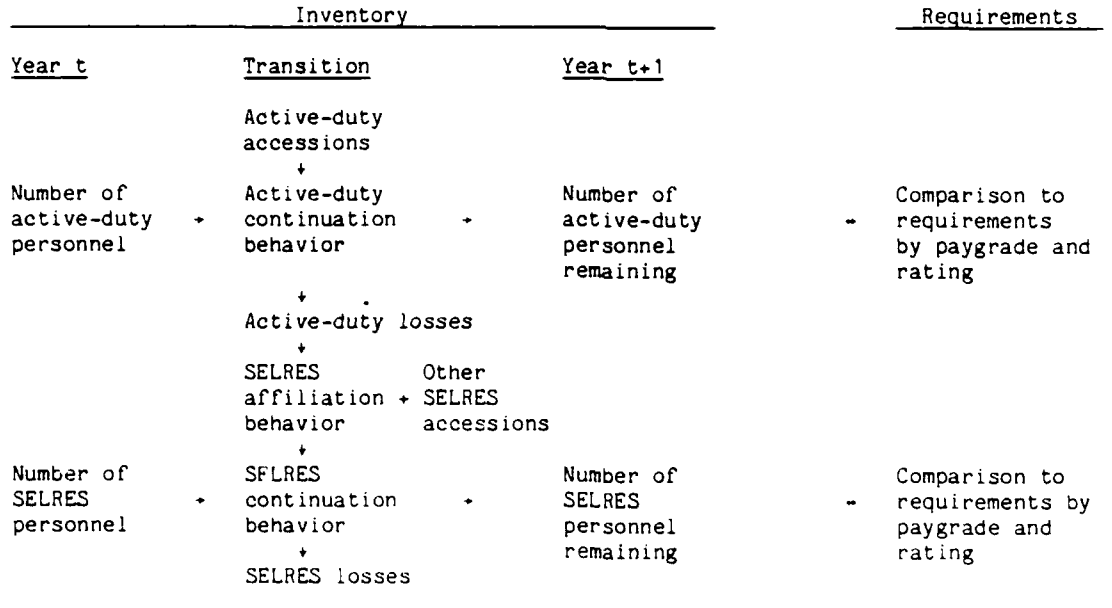

FIG. 1: BASIC SIMULATION FLOW

ACTIVE-DUTY SIMULATION

The basic component of the simulation is the inventory of existing enlisted personnel. Because of the focus on the mix of enlistment programs, the inventory is categorized into six enlistment programs. These are described in table 1. For each of these enlistment programs, the inventory is tabulated from the Enlisted Master Record (EMR) by LOS and rating. Beginning at LOS equal to ten years, the enlistment-program dimension of the inventory is collapsed, so that inventory tabulations for cells with LOS greater than nine do not have an enlistment-program dimension. The inventories for LOS 10 through LOS 31 are dimensioned only by rating and LOS. The LOS 31 cells include counts of individuals with longer service.

TABLE 1

ENLISTMENT PROGRAMS

Program	Description
4YO	Individuals whose original enlistment carries a four-year obligation of service
AM	Individuals designated on the Enlisted Master Record (EMR) as Active Mariner enlistees
5/6YO	Individuals whose original enlistment carries a five- or six-year obligation of service
PS	Individuals designated on the EMR as prior-service enlistees
TEP	Individuals identified on the EMR as Training and Administration of Reserves enlistees (TAR Enlistment Program)
NSCP	Navy Sea College Program, first accessions in FY 1987

NOTE: Refer to Research Memorandum 87-94 (Vol. II), appendix B, for more detailed information on the tabulation of inventories by enlistment program.

Computation of Transition Behavior

Two approaches to measuring continuation behavior are available. Continuation rates based on cell counts are computationally simple. However, such rates are less accurate than those produced by tracking year-to-year continuation for each individual in the enlisted force. For reasons of tractability, the original version of the simulation did not attempt to follow the continuation behavior of each individual, but instead used cell counts of individuals from the EMR for each combination of enlistment program, rating group, and LOS. The problem with this method is the large number of rating transfers among those continuing in service. Simple continuation rates may exceed 1.0 and lead to implausible predictions. Furthermore, when individuals change ratings between years, the estimated continuation rates for the original ratings reflect losses from the rating but not from the Navy. It is not possible to accurately identify Navy losses using the cell-count method. This is important for simulating the flow between active duty and SELRES. However, despite efforts to minimize the effects of lateral rating transfers, many of the continuation rates calculated from cell counts for the lower LOS cells were greater than or equal to 1.0.

The existence of this complication associated with using cell counts was anticipated but its severity was not appreciated. Three means of reducing the extent of the lateral transfer problem were used to calculate continuation rates based on cell counts. First, the Personalized Recruiting for Immediate and Delayed Entry (PRIDE) data were used to identify the enlistment program and rating designation of new recruits at the time of enlistment. This should have resulted in an improved determination of the rating that an individual could be expected to attain relative to the rating assignment appearing on the EMR. A large number of individuals listed as general detail (GENDET) Seamen, Airmen, or Firemen on the EMR are in fact training for a rating as designated on the PRIDE data. Second, to avoid additional turmoil in rating designation associated with switching between the PRIDE and EMR data bases, only average LOS 1 to LOS 2 continuation behavior for all ratings and enlistment programs was used.

Finally, some ratings, such as Navy Counselor and Master at Arms are only open to experienced personnel. Individuals serving in these ratings could not have enlisted into them. Also, several middle paygrade ratings sometimes combine to form a new rating at the chief paygrades. These expected lateral transfers proved difficult to model accurately. Thus, the simulation uses 69 rating groups based on those ratings having a master chief paygrade (excepting the GENDET categories). Table 2 presents these ratings and their constituents.

TABLE 2

RATING GROUP DEFINITIONS FOR THE SIMULATION

Rating group	Included ratings (if different)
AN: Airman	
AB: Aviation Boatswain's Mate	ABE: AB, Launch and Recovery Equipment
	ABF: AB, Fuels
	ABH: AB, Aircraft Handling
AC: Air Traffic Controller	
AF: Aircraft Maintenance Technician	AD: Aviation Machinist's Mate
	ADJ: AD, Jet Engines
	ADR: AD, Reciprocating Engines
	AM: Aviation Structural Mechanic
	AME: AM, Safety Equipment
	AMH: AM, Hydraulics
	AMS: AM, Structures
AG: Aerographer's Mate	
AK: Aviation Storekeeper	
AO: Aviation Ordnanceman	
AS: Aviation Support Equipment Technician	ASE: AS, Electrical
	ASH: AS, Hydraulics
	ASM: AS, Mechanical
AV: Avionics Technician	AE: Aviation Electrician's Mate
	AQ: Aviation Fire Control Technician
	AT: Aviation Electronics Technician
	AX: Aviation Antisubmarine Warfare Technician
AW: Aviation Antisubmarine Warfare Operator	
AZ: Aviation Maintenance Administration	
BM: Boatswain's Mate	
BT: Boiler Technician	
CN: Constructionman	
CTA: Cryptologic Technician, Administrative	

TABLE 2 (Continued)

Rating group	Included ratings (if different)
CTI: Cryptologic Technician, Interpretative	
CTM: Cryptologic Technician, Maintenance	
CTO: Cryptologic Technician, Communication	
CTR: Cryptologic Technician, Collection	
CTT: Cryptologic Technician, Technical	
CU: Construction	BU: Builder EA: Engineering Aid SW: Steelworker
DT: Dental Technician	DN: Dentalman
DK: Disbursing Clerk	
DM: Illustrator Draftsman	
DP: Data Processing Technician	
DS: Data Systems Technician	
EM: Electrician's Mate	IC: Interior Communications Electrician
EN: Engineman	
EQ: Equipmentman	CM: Construction Mechanic EO: Equipment Operator
ET: Electronics Technician	
EW: Electronics Warfare Technician	
FN: Fireman	
FT: Fire Control Technician	FC: Fire Control FTB: FT, Ballistic Missile Fire Control FTM: FT, Surface Missile Fire Control MT: Missile Technician
GM: Gunner's Mate	GMG: GM, Guns GMM: GM, Missiles GMT: GM, Technician
GS: Gas Turbine System Technician	GSE: GS. Electrical GSM: GS, Mechanical
HM: Hospital Corpsman	HN: Hospitalman
HT: Hull Maintenance Technician	DC:[a] Damage Control Technician
IS: Intelligence Specialist	
JO: Journalist	

a. This new rating does not have any members until FY 1987.

TABLE 2 (Continued)

Rating group	Included ratings (if different)
LI: Lithographer	
LN: Legalman	
MA: Master-at-Arms	
ML: Molder	
MM: Machinist's Mate	
MN: Mineman	
MR: Machinery Repair	
MS: Mess Management Specialist	
MU: Musician	
NC: Navy Counselor	
OS: Operations Specialist	
OT: Ocean System Technician	OTA: OT, Analyst OTM: OT, Maintenance
PC: Postal Clerk	
PH: Photographer's Mate	
PI: Precision Instrumentman	OM: Opticalman IM: Instrumentman
PM: Patternmaker	
PN: Personnelman	
PR: Aircrew Survival Equipmentman	
QM: Quartermaster	
RM: Radioman	
RP: Religious Program Specialist	
SN: Seaman	
SH: Ship's Serviceman	
SK: Storekeeper	
SM: Signalman	
ST: Sonar Technician	STG: ST, Surface STS: ST, Submarine
TD: Training Devices Man	
TM: Torpedoman's Mate	
UT: Utilitiesman	
YN: Yeoman	CE: Construction Electricianman

Despite efforts to reduce the effects of rating changes on continuation rates produced from cell counts, the results were not very encouraging. Overall, the average continuation behavior of active-duty personnel was not systematically in error. The rating-group components required very careful interpretation, however, and were not suitable for gauging within rating-continuation behavior in the early years of service. Adequately addressing these issues required tracking individual transitions from year to year.

Computation of Transition Behavior for Accessions

Accessions constitute one type of transition behavior (figure 1). The LOS 1 inventory of non-prior-service personnel at the end of the fiscal year is determined by new accessions during the year and within-year attrition. Prior-service accessions enter the LOS cohort corresponding to their cumulative length of past service. The distribution of prior-service accessions in the simulation is based on the LOS and rating distribution for this program in FY 1986. Prior-service accessions during FY 1986 do not affect the calculation of continuation behavior.

Because of the differences in rating assignments on the EMR and the PRIDE, the transition from FY 1984 LOS 1 (as observed on the PRIDE accession file) to FY 1986 LOS 3 is identified for each individual. The following analytical decisions concerning incomplete information from the PRIDE-EMR match for each individual were required:

(1) Individuals shown as accessions on PRIDE but with no EMR record were not included as accessions.

(2) Individuals included as accessions but not matching the FY 1986 EMR were counted as losses, along with those individuals appearing on the September 1986 EMR with loss codes.

(3) Individuals not showing a rating classification on the PRIDE, but indicated as a GENDET accession, were assigned to the Seaman rating for FY 1984.

(4) Individuals not showing a rating classification on the PRIDE, not indicated as a GENDET accession, and showing a rating on the EMR were treated as accessions into the rating shown on the EMR.

(5) Individuals not showing a rating on the EMR were excluded from the tabulations.

Using these rules for classifying individual observations in the PRIDE-EMR match, the calculation of continuation rates for LOS 1 through 3 is the same as described in the following section.

Computation of Other Transition Behavior

For individuals with LOS 3 or greater at the end of FY 1985, continuation behavior is calculated by observing the status of these individuals at the end of FY 1986. (Similar calculations can be repeated for other years.) The continuation behavior of each individual on active duty at the end of FY 1985 is categorized as follows: (1) continued on active duty in the same rating; (2) continued on active duty in a different rating (lateral transfers into and out of each rating are counted separately); and (3) lost from active duty. Using these tabulations, within-rating continuation and loss rates are easily computed, and are bounded between zero and one. The redistribution of individuals among ratings associated with lateral transfers is modeled in a two-step process. First, the number of lateral transfers out of ratings within an enlistment program is used to compute the lateral transfer rate for that program. Second, the number of lateral transfers into each rating within an enlistment program is used to calculate the percentage of total transfers expected to appear in each rating group.

This procedure produces within-rating continuation rates, lateral-transfer rates, and loss rates by enlistment program, rating group, and LOS for LOS 3 through 31.

Application of Continuation Behavior

For consistency, the application of measured continuation behavior mirrors its computation. In general, given the inventory tabulation for some year, the next year's simulated inventory is obtained by multiplying the computed historical continuation rates by last year's inventory, and adding the lateral transfers for each rating, program, and LOS combination. The exceptions to this rule are LOS cells 1 through 3. LOS 3 for year $t+1$ is obtained by applying the LOS 1 to LOS 3 continuation behavior to the LOS 1 inventory of year $t-1$. The LOS 2 inventory for year $t+1$ is computed by multiplying the LOS 1 inventory in year t (in every cell) by the average continuation rate from LOS 1 to LOS 2. Recall that, through LOS 9, the continuation behavior tracks the inventory by original enlistment program. Beyond that, continuation is by rating and LOS only. The result is next year's simulated inventory for LOS cells 2 through 31. LOS 1 inventories by enlistment program and rating are determined directly from user-specified accessions by enlistment program and rating and within-year continuation (FY 1986 average) for LOS 1.

Active-Duty Losses

Individuals leaving active duty may affiliate with the SELRES, and in the case of the AM enlistment program, have an obligation to affiliate. To account for the flow of individuals from active to reserve duty, it is necessary to account for losses from active duty by

enlistment program. Active-duty loss rates by enlistment program, rating, and LOS are computed as part of the continuation behavior. Using individual observations makes accurate tracking of loss rates by rating possible, even in the presence of significant lateral (cross-rating) flows.

On the other hand, the method employing cell counts cannot accurately track these losses. Ratings from which individuals go to other ratings have artificially low continuation rates. Continuation rates exceeding 1.0 identify some but not all of the rating, program, and LOS cells to which these lateral transfers go. Cells that have artificially high continuation rates less than 1.0 cannot be identified. Losses from (unidentifiable) ratings that are the source of lateral flows are overestimated by the application of the simple continuation rate. On the other hand, losses from (unidentifiable) ratings that are the targets of lateral flows are underestimated. The distribution of simulated losses across ratings is less accurate when the unobserved flows between ratings becomes greater. Aggregate losses are overestimated because there is no mechanism for tracking the additions to ratings (for those cells with continuation rates greater than 1) back to the ratings from which they came. Tracking lateral transfers for individuals on the EMR solves these problems.

Comparison of Active Inventory to Requirements

Gauging the relative advantages of alternative accession profiles demands comparison to an objective. For the purposes of this study, active-duty (and SELRES) enlisted requirements are taken from the Enlisted Programmed Authorizations (EPA).[1] These authorizations are provided by paygrade and rating. Because the ratings have been combined as shown in table 2, the authorizations are also totaled across ratings where appropriate.

The simulated inventory in year t is not dimensioned by paygrade, but can be translated to the paygrade-rating format by using observed distributions of paygrade by LOS for each rating. Using the EMR, the inventories of several recent years were examined for differences in the distribution of paygrade by LOS and rating. Because the differences appeared insignificant, the distribution tabulated for the most recent year then available (FY 1985) was chosen to represent the paygrade distribution by rating. For each rating, the total number of individuals in the simulated inventory for each LOS is allocated to various paygrades according to the observed FY 1985 fractions, and then summed for each paygrade by rating.

1. The authorizations of March 1986 are used. Manpower and Personnel, Navy (MPN) authorizations are used, including TAR authorizations.

SELRES SIMULATION

The structure of the SELRES simulation is similar in many respects to the active-duty simulation. SELRES enlistment programs include recent NAVETs (other than AM), recent AMs, Sea and Air Mariners (SAMs), and all other accessions (OTHER). In this case, "recent" means that the NAVET or AM affiliated with SELRES in the fiscal year that the member left active service, or the next fiscal year. The first two programs are associated with current active-duty losses in the simulation. SAMs are recruited directly into SELRES and have no prior service. OTHER SELRES accessions are drawn from a large pool of less recent losses from Navy active duty, veterans from other services, and experienced civilian personnel who enter at higher paygrades than SAMs and do not require skill training.

The SELRES inventory is tabulated from the Inactive Enlisted Master File (IEMF) for these 4 enlistment programs, the 69 ratings in table 2, and 7 LOS categories. LOS 7 includes all individuals showing more than seven years of service in SELRES. As in the active-duty simulation, the end of FY 1985 inventory is used to begin the simulation.

Accessions

Each year's accessions (LOS 1) must be allocated to some SELRES enlistment program and rating for the simulation to proceed. For recent NAVETs and AMs, the total number and distribution of accessions is determined by affiliation rates computed for these groups. This was done by identifying individual losses from active duty directly from the EMR and matching these loss files to the appropriate IEMF. Affiliation rates are obtained by dividing the number of matches by entry program (NAVET or AM) and rating by the number of losses in that cell. Because cell counts are used, only net affiliations can be computed. If losses from one rating affiliate with SELRES in a different rating, this behavior will be captured as a low affiliation rate in the loss rating and a high affiliation rate in the gain rating. Furthermore, some initial attrition is reflected in the affiliation rates because end of fiscal year inventories are used.

The affiliation rates used in the simulation are for active-duty losses from FY 1985. In some rating and program combinations, very few losses are observed for that year. If there are significant changes in the distribution of losses by enlistment program, the use of rates computed from small samples may be inappropriate. A method for adjusting such rates that uses both rating-specific and full-sample information is discussed in [2]. Additional information on its application is presented in [1]. The procedure moves all computed affiliation rates toward the overall mean; large cells are adjusted least. In its application to the ratings, the procedure is applied separately to (1) the GENDET classifications, and (2) all other ratings. The affiliation behavior of these two groups is substantially

different, with GENDETs showing very low affiliation rates. Using two separate adjustments capitalizes on this difference.[1] With these affiliation rates and the number of active-duty losses by enlistment program and rating, both the number and allocation of AM and NAVET accessions to ratings is determined.

The number of SAM accessions is a policy decision and is an input to the simulation in future years. Ninety-percent of SAM accessions are assumed to survive to the end of the fiscal year. The allocation of SAMs to ratings may also be changed during the course of the simulation to any desired configuration. For the purpose of demonstration, the actual LOS 1 SAM rating distribution at the end of FY 1985 is used. As with active-duty accessions, many FY 1985 SAMs are still in training at this time, so the accessions into GENDET ratings are exaggerated. To more accurately assign SAMs to their intended ratings, first-year SAMs with GENDET ratings are assigned the rating they show at the end of FY 1986.

The number of OTHER SELRES accessions is also a user input to the simulation. This input should reflect within-year attrition, rather than the number of accessions per se. These include non-recent NAVETs (including AMs), advanced paygrade (APG) accessions, other service veterans (OSVETs), and reserve veterans (RESVETs) whose last Navy service was with SELRES. APGs and OSVETs account for about 3,000 accessions per year. The remainder are RESVETs and non-recent NAVETs, although no explicit analysis of the source of these accessions was made. This category is treated as a residual because the size and enlistment propensities of these groups could not be adequately modeled. The rating distribution of the OTHER accessions is derived from the FY 1985 actual distribution. No provision currently exists to change the rating allocation of these accessions during the simulation process.

Computation of Continuation Behavior

The major difference between the active-duty simulation and the SELRES simulation is in the method of calculating continuation rates. The continuation rates currently used in the SELRES simulation are derived by counting the number of reservists in a particular rating, entry program, and LOS at the end of each fiscal year from 1979 through 1986. This number is then divided by the number in that rating and

1. A behavioral analysis of NAVET affiliation is contained in [3]. The analysis controls for the effects of demand constraints on observed affiliation. Such an adjustment is not attempted here. If binding demand constraints produce lower affiliation rates in some ratings than would be observed in the absence of these constraints, the simulations of affiliation behavior must be interpreted as being conditional on the recent pattern of demand constraints.

entry program who have one year less service at the end of the previous year. The use of 69 rating groups reduces the flows between ratings in the tabulations so that simple continuation rates for SELRES only exceed 1.0 in a few cases. For most of these cases, the numerator cell count exceeds the denominator by one individual. No significant lateral transfers are apparent, so the few affected continuation rates are set equal to 1.0. Unlike the active simulation, no lateral transfer rates are necessary for the SELRES simulation. However, the continuation rates for the SELRES must be interpreted as the net of lateral transfers.

Application of Continuation Behavior

The application of continuation rates again mirrors the derivation. Next year's inventory is simulated by multiplying the continuation rate times the previous year's inventory in the appropriate program, rating, and LOS cell. In this case, the use of simple continuation rates yields LOS 2 through 7 inventories. LOS 7 includes those with longer service. LOS 1 inventories by enlistment program and rating are determined by accessions and within-year attrition as described above.

Comparison of Reserve Inventory to Requirements

The simulated SELRES inventories by LOS, enlistment program, and rating are translated to inventories dimensioned only by paygrade and rating for comparison with reserve EPA.[1] Paygrade information about the inventory is obtained by computing the average paygrade distribution for each LOS, rating, and program from the September 1985 IEMF. In the calculation, SAM GENDETs were handled in the same manner as in the inventory tabulations. This paygrade distribution for each rating is then applied to the rating inventory by LOS, summed over enlistment programs. The resulting paygrade inventories for each rating are then summed and can be compared with EPA.

OBSERVED CONTINUATION AND AFFILIATION BEHAVIOR

A brief discussion of measured continuation and affiliation behavior by enlistment program provides useful background for the simulation examples that follow. Average continuation and lateral transfer rates within enlistment programs mask significant variation between rating groups. A complete table of rates is presented in [1].

Table 3 lists the calculated transition behavior using individual data. The continuation rate in rating is the percentage of individuals in the begin year (1985 except for LOS 1 through 3) that were still on active duty in the same rating the following year (September 1986). The

1. The authorizations as of March 1986 are used.

percent of individuals in the enlistment program with different rating assignments between the two observations is the lateral transfer rate. The loss rate indicates the percentage no longer on active duty. The overall continuation rate is the sum of the continuation in rating and lateral transfer rates.

TABLE 3

FY 1986 ACTIVE-DUTY CONTINUATION
BEHAVIOR BY ENLISTMENT PROGRAM
(Percent)

		LOS						
Program		1→3	3→4	4→5	5→6	6→7	7→8	8→9
4YO	Continuation in rating	50.2	83.9	47.7	78.4	86.7	90.1	85.9
	Lateral transfer	23.4	8.2	2.7	1.8	1.0	0.7	0.9
	Loss	26.4	7.9	49.6	19.8	12.2	9.2	13.2
AM	Continuation in rating	58.6	37.2	68.2	85.3	87.6	84.7	88.2
	Lateral transfer	24.0	7.7	5.2	1.5	1.2	1.4	1.1
	Loss	17.4	55.1	26.6	13.2	11.2	13.9	10.7
5/6 YO	Continuation in rating	75.2	90.1	83.9	78.8	63.6	87.2	86.2
	Lateral transfer	10.3	3.6	1.4	1.0	0.5	0.6	0.4
	Loss	14.5	6.3	14.7	20.2	35.9	12.2	13.4
PS	Continuation in rating	34.1	74.9	72.7	78.4	85.6	86.6	86.1
	Lateral transfer	18.9	9.2	10.4	10.6	3.2	2.2	1.5
	Loss	47.0	15.8	16.9	11.0	11.2	11.2	12.4
TEP	Continuation in rating	70.6	93.7	66.9	89.0	90.4	94.7	90.7
	Lateral transfer	21.4	2.6	1.2	0.8	1.8	1.3	0.0
	Loss	8.0	3.7	31.9	10.2	7.8	4.0	9.3

NOTE: These rates are computed from individual data as described in the text. The transitions from LOS 1 to LOS 3 are based on FY 1984 accessions.

The differences in continuation behavior between enlistment programs follow a plausible pattern. Significant declines in continuation rates are seen at the expected reenlistment points for the 4YO, AM, 5/6 YO and TEP programs. The largest lateral transfer rates are in the LOS 1 through 3 4YO, AM, and TEP programs. This illustrates the extent of lateral flows associated with early rating assignments, especially where GENDET personnel compose a significant portion of the

inventory. Prior-service individuals with at least five years of service have continuation behavior that closely parallels the 4YO behavior for transitions between LOS 5 and LOS 9. This is indicative of a general convergence in continuation behavior across enlistment programs. (Recall that for LOS 10 and beyond, continuation rates are averaged across enlistment programs.) Prior-service personnel with little military experience have unexpectedly high loss rates.

This observed behavior for 1986 is placed in perspective by comparing it to behavior for other years since 1982. The continuation calculations for the other years in table 4 are based on cell counts rather than tracking the behavior of individuals. Some differences in the calculated rates are apparent for 1986, but the rates are similar enough to justify the comparison.[1] Cumulative retention (beyond the first term) in all three programs is down slightly from its peak in FY 1983, with the biggest decline in the AM program. The continuation behavior of the enlisted community has been relatively stable since 1982. However, small changes in the rates lead to large changes in absolute inventory when the number of affected individuals is large.

In addition to these general differences between enlistment programs, differences between programs in specific ratings can also be identified. For example, there are several ratings where AM cumulative continuation to LOS 5 exceeds that of 4YO personnel. The ratings where this occurs include AG (44.3 percent versus 33.5 percent), AS (38.9 percent versus 31.6 percent), EM (24.2 percent versus 20.9 percent), and MR (24.3 percent versus 20.2 percent). Because AMs have only a three-year obligation, these continuation differences are unexpected. The reasons for AMs having better continuation in these ratings has not been examined in detail. Using the tables in [1], other continuation-rate comparisons between AM and 4YO enlistments show several additional ratings where redistributing from 4YO to AM would have little negative effect on active-duty inventories.[2] In the aggregate, however, AM continuation through LOS 5 is lower than for 4YOs.

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1. The differences are due to changes in the program-enlisted-for field on the EMR when individuals switch from active duty to TAR. This reduces the net continuation rates for all programs except TEP. The TEP continuation rate based on cell counts tends to exceed one in the early LOS cells. The individual transitions fix the enlistment program at the begin-year value.
2. Continuation behavior reflects a combination of personal characteristics and Navy experience. Either or both factors may be responsible for these anomolies.

TABLE 4

RECENT CONTINUATION BEHAVIOR
BY ENLISTMENT PROGRAM
(Percent)

Program		LOS 1→3[a]	3→4	4→5	5→6	6→7	7→8	8→9
4YO	1982 to 1983	85	89	51	82	91	94	93
	1983 to 1984	85	89	48	82	89	92	88
	1984 to 1985	82	89	48	83	88	90	85
	1985 to 1986	81	92	49	81	88	91	87
	1985 to 1986[b]	77	92	50	80	88	91	87
AM	1982 to 1983	89	48	79	95	93	90	97
	1983 to 1984	85	44	75	88	89	89	90
	1984 to 1985	87	44	74	88	89	88	92
	1985 to 1986	84	45	75	88	90	87	91
	1985 to 1986[b]	73	45	73	87	89	86	89
5/6 YO	1982 to 1983	94	93	85	86	57	38	77
	1983 to 1984	92	93	84	83	59	85	87
	1984 to 1985	88	93	84	80	62	87	85
	1985 to 1986	87	95	86	79	63	87	86
	1985 to 1986[b]	85	94	85	80	64	88	87

NOTE: Based on cell counts by enlistment program and LOS.

a. These rates are based on LOS 1 survivors rather than accessions. Rates computed from individual observations are lower since they also reflect attrition during the first year of service. The transitions from LOS 1 to LOS 3 are based on FY 1984 accessions.

b. Continuation rates from individual data. These are the rates implicit in the examples of the simulation presented in the next section.

These observations on continuation-rate differences between active-duty enlistment programs are not exhaustive. Reference [1] provides a complete list of the continuation, lateral transfer, and loss rates by enlistment program, rating, and LOS.

SELRES affiliation rates are expected to be much larger for AM losses than for other NAVETs. For FY 1985 losses, the average affiliation rate for AM losses is 47 percent (67 percent excluding GENDETs). By contrast, the average affiliation rate of other NAVET losses is 7 percent. There is, however, a wide range of rates across

ratings for both active-duty categories. For NAVETs the adjusted rates range from 3 to 19 percent. For AMs the adjusted rates range from 15 to 82 percent. This difference in affiliation rates implies that a significant shift toward AM accessions would increase SELRES inventories.

Table 5 presents average continuation behavior by SELRES program and LOS. Reference [1] describes the derivation of these rates in detail. The continuation rate for LOS 1 through 2 in table 4 is based on LOS 1 survivors rather than accessions. As with the active-duty continuation rates, the pattern of rates between programs and across LOS cells within programs is plausible. The only surprise is the declining continuation rates with increasing LOS for SAMs. This result has also been found, but not explained, by other ongoing CNA research. In general, those obligated to SELRES have greater initial continuation, but exhibit reenlistment behavior similar to the active enlisted force. Recent NAVETs and OTHERs have lower initial continuation, but do not exhibit systematic cohort effects associated with reenlistment decisions after a specified period of service.

TABLE 5

AVERAGE SELRES CONTINUATION RATES BY PROGRAM

Program	1-2	2-3	3-4	4-5	5-6	6-7	> 7
NAVET	54.4	66.4	77.2	80.1	93.4	86.0	89.6
AM	72.4	40.8	44.7	70.7	78.5	82.1	87.6
SAM	79.1	77.7	75.3	72.6	70.4	37.3	60.0
OTHER	67.1	71.1	76.9	82.9	84.8	88.1	87.4

SIMULATION EXAMPLES

The simulation is designed to estimate the changes in active-duty and reserve inventories associated with alternative accession profiles. Changes are determined by comparing the results of two simulations with different numbers or distributions of accessions among enlistment programs or ratings. For the examples reported below, the results of a base case are compared to four other simulations. The first alternative determines the number of accessions per year between FY 1988 and FY 1991 required to attain active-duty EPA for 1991. The second alternative reallocates accessions from the 4YO enlistment program to the AM program, leaving the total number of accessions the same as the base case in each year. The third example examines the effects of replacing Navy Sea College accessions with the base-case mix of other accessions.

Finally, the effect of shifting 3,000 accessions per year from 4YO to prior-service enlistments is simulated.

Base Simulation

The base simulation serves as a reference point for the other three alternatives. The aggregate number of active-duty accessions for FY 1988 and beyond is set at 95,000 per year. This corresponds approximately to the accession-plan total for the two preceding fiscal years. The allocation of accessions to enlistment programs is also based on recent accession patterns, as presented in table 6. Table 7 presents the allocation of accessions to rating groups, based on the FY 1988 school loading plans for CNRC. Most of the rating-group allocations exceed the CNRC allotment by 4 to 14 percent. SAM accessions are based on 1986 actual accessions and the plan for FY 1987. OTHER reserve accessions are a residual, and are subject to more uncertainty than any of the other accession components in the simulation. AM and NAVET accessions are based on measured affiliation rates for these groups.

TABLE 6

DISTRIBUTION OF ACCESSIONS BY ENLISTMENT PROGRAM: BASE SIMULATION

	Active duty			
Program	1986	1987	1988-1991	1992-1995
4YO	54,097	51,247	51,032	51,124
AM	15,700	15,700	15,700	15,700
5/6 YO	17,000	17,000	17,184	17,000
PS	6,500	6,500	6,627	6,623
TEP	1,603	1,553	1,457	1,553
Sea College	0	3,000	3,000	3,000
Total	94,900	95,000	95,000	95,000

	Reserve			
Program	1986	1987	1988-1991	1992-1995
SAM	8,100	7,100	7,100	7,100
OTHER	9,000	10,000	10,000	10,000

NOTE: Though presented in the table and used in the simulation, the last two digits of the distribution of accessions by enlistment program are of no practical importance.

TABLE 7

ALLOCATION OF ACCESSIONS TO RATING GROUPS
FOR BASE CASE
(FY 1988-FY 1991)

Rating group	Simulation allocation	CNRC FY 1988 A-school allotment	Rating group	Simulation allocation	CNRC FY 1988 A-school allotment
AN	8,049	---	EM	3,098	2,978
AB	931	1,045	EN	1,237	1,099
AC	447	390	EQ	342	300
AF	3,190	2,955	ET	3,637	3,511
AG	177	155	EW	501	527
AK	674	623	FN	7,597	---
AO	1,019	900	FT	2,642	2,380
AS	259	228	GM	1,073	943
AV	2,961	2,742	GS	613	626
AW	664	625	HM	4,467	3,900
AZ	405	359	HT[a]	2,160	1,894
BM	245	---	IS	266	235
BT	1,467	1,290	JO	107	97
CN	3	---	LI	46	41
CTA	97	85	LN	4	---
CTI	313	276	MA	13	---
CTM	320	280	ML	32	28
CTO	270	245	MM	5,225	4,841
CTR	344	240	MN	79	69
CTT	320	282	MR	280	247
CU	1,500	1,368	MS	2,967	2,665
DN	419	365	MU	78	70
DK	287	284	NC	1	---
DM	10	---	OS	1,930	1,735
DP	320	305	OT	326	286
DS	416	365	PC	134	141
PH	311	275			
PI	93	81			
PM	11	10			
PN	593	570			
PR	238	211			
QM	607	535			
RM	2,822	2,620			
RP	136	120			
SN	18,959	---			
SH	666	590			
SK	946	824			
SM	614	540			
ST	2,150	1,993			
TD	6	---			
TM	621	547			
UT	297	260			
YN	1,265	1,175			

NOTE: The rating distribution presented here should be viewed as a rough approximation to current distribution policy.
a. Includes A-school allotment for the new Damage Control (DC) rating.

A-school plans respond to current shortages and excesses in ratings, and are adjusted by planners to eliminate the differences in less than five years. Thus, it is unrealistic to use the FY 1988 A-school plan to adjust accessions by rating for each year from FY 1988 through FY 1991. However, tailoring each year's accessions to accommodate near-term shortages and excesses requires knowledge of distribution priorities and constraints that are properly the concern of Navy manpower planners. The simulations presented here demonstrate what could be expected to happen to rating-group inventories if allocations similar to the FY 1988 A-school plan were to be continued.

Finally, some specific assumptions about the new FY 1987 (and future) Navy Sea College accessions are needed. Beginning in FY 1987 and continuing into the future, 3,000 new accessions are allocated to the Sea College Program. They are distributed among the GENDET ratings in proportions reflecting the relative sizes of those ratings. An examination of continuation behavior by similar high-quality GENDET recruits of the recent past (using SCREEN [4]) indicates one-year survival rates of about 90 percent.[1] Thus, 2,700 of the 3,000 accessed are assumed to remain on active duty at the end of their accession year. The reenlistment behavior of these recruits is very uncertain. A reenlistment rate of 10 percent of those remaining is assumed. This 10 percent is hypothetically allocated among more technical ratings associated with the GENDET rating as listed in table 8. However, the total number is small enough that it does not affect any rating significantly. As with particular elements of the allocation of new accessions to ratings and enlistment programs, these assumptions may be altered in consultation with accession planners.

TABLE 8

ASSUMED DISTRIBUTION OF SEA COLLEGE REENLISTMENTS AMONG RATING GROUPS

GENDET classification	Rating	Percent of LOS 2 inventory
AN	AV	.10
FN	FT	.10
SN	CTO	.02
	ET	.01
	EW	.02
	GS	.02
	OS	.02
	ST	.01

1. This coincides with recent Army experience with two-year enlistments.

Base-Simulation Results

The base simulation uses FY 1986 continuation behavior and begins with the FY 1985 inventory. Aggregate results for active and reserve inventories are presented in table 9. Active enlisted inventory grows by about 3.5 percent by FY 1991, and the SELRES inventory grows by 5.8 percent. Neither grows as fast as EPA. Significantly greater accessions will likely be required to reach EPA for FY 1991.

TABLE 9

RESULTS OF BASE SIMULATION:
ACTIVE AND RESERVE INVENTORIES BY YEAR

End of fiscal year	Active	Active EPA	Reserve	Reserve EPA
1986	521,612	520,535	97,757	102,516
1987	526,614	534,241	100,905	108,719
1988	530,396	542,280	102,383	113,991
1989	532,938	552,572	103,024	115,472
1990	536,443	557,469	103,187	116,809
1991	539,893	561,711	103,425	116,910

Because the calculated continuation behavior associated with FY 1986 is applied to the September 1985 inventory, the simulated inventory for September 1986 should be close to the actual inventory. In fact, the simulated inventory for FY 1986 exceeds the actual inventory by about one-half of 1 percent (about 2,500 individuals). This error is almost entirely contained in LOS cell 1. Although the exact source of the difference has not been determined, the difference is so small that consistent application of continuation behavior may be regarded with some confidence, especially for LOS 3 and greater in the near term.

The simulated enlisted active-duty force for FY 1991 contains a more senior paygrade mix than the EPA. This is illustrated in table 10. Paygrades E-6 through E-8 are larger percentages of the simulated inventory than those paygrades are in the EPA. Paygrades E-4 and E-5 are underrepresented relative to the EPA. Even with the relatively small simulated inventory, there are significant absolute excesses at E-6 and E-7. The simulated paygrade structure reflects the experience of the inventory as measured by LOS and historical relationships between LOS and paygrade. As the inventory becomes more senior due to higher retention rates than the 1978 through 1981 period, the promotion patterns of recent years may change in observance of the EPA constraints. Slower promotion rates are expected to reduce retention. It has not been possible to quantify this hypothesis in the simulation.

TABLE 10

SIMULATED PAYGRADE DISTRIBUTION AND
REQUIREMENTS FOR BASE CASE

Paygrade	Base case	Percent	EPA	Percent
E-1 through E-3	173,005	32.04	167,932	29.90
E-4	100,145	18.55	124,826	22.22
E-5	105,841	19.60	116,402	20.72
E-6	98,283	18.20	94,571	16.84
E-7	45,223	8.38	40,230	7.16
E-8	12,689	2.35	12,444	2.22
E-9	4,707	0.88	5,306	0.94
Total	539,893	100.00	561,711	100.00

In general, caution should be exercised when interpreting the absolute numbers of individuals in any rating, program, and LOS cell of the inventory. The simulation is best used to predict differences in personnel inventory associated with alternative enlistment-program mixes. This is due to uncertainty in the analysis regarding the actual recent and future distributions of new accessions among the rating groups and enlistment programs. Navy manpower planners using the simulation may be able to more accurately foresee these distributions. In the following discussion of alternative allocations of new accessions among rating groups and programs, only differences between the simulated total inventories are presented.

Alternative 1: Accessions Required To Reach FY 1991 EPA

Base-case accessions of 95,000 per year from FY 1988 through FY 1991 combined with FY 1986 continuation behavior result in active-duty endstrength of about 540,000 at the end of FY 1991. This is about 20,000 short of the FY 1991 EPA. Because of the large size of the inventory, an increase of about one percentage point per year in the average continuation rate over a five-year period can eliminate this shortfall. Alternatively, holding the continuation rates constant at the values observed in FY 1986, more accessions are required in the simulation to achieve the FY 1991 EPA. Table 11 presents the results of a simulation with 102,000 active-duty accessions per year during the 1988 through 1991 period. By 1991, the total EPA is met although the rating and paygrade distribution is not.

TABLE 11

RESULTS OF ALTERNATIVE 1:
ACTIVE AND RESERVE INVENTORIES BY YEAR

End of fiscal year	Active	Active EPA	Reserve	Reserve EPA
1986	521,612	520,535	97,757	102,516
1987	526,614	534,241	100,905	108,791
1988	536,752	542,280	102,384	113,991
1989	545,731	552,572	103,027	115,472
1990	553,909	557,469	103,285	116,809
1991	561,216	561,711	103,635	116,910

The increase in accessions also changes the experience profile of the inventory at the end of FY 1991. Most of the increment is in paygrades E1 through E3, although there are 6,000 additional E-4 and 2,000 additional E-5 personnel in the higher-accession scenario. The resulting paygrade distribution is still too rich at the low and high ends, and insufficient to meet EPA in the E-4 and E-5 grades.

The reserve inventory is left virtually unaffected by the increase in accessions, at least through 1991. The simulation yields a SELRES inventory only several hundred greater than the base case.

Alternative 2: Shift of 3,000 Accessions From 4YO to AM

In this alternative, the mix of active-duty accessions is changed, rather than the number. AM accessions are increased by 3,000 each year, beginning in FY 1988, and the total number of accessions is kept constant by reducing 4YO accessions by 3,000 per year. Because AMs have a three-year active-duty obligation rather than four years, this change is expected to reduce the active inventory in the future. On the other hand, AMs have an obligation to SELRES that other NAVETs do not. SELRES inventories should increase as a result of the shift of accessions.

The resulting inventories are presented in table 12. By FY 1991, the active inventory is simulated to decline by about 1,000. This is equivalent to a reduction in accessions of about 300 to 500 per year. However, the losses are concentrated entirely in the E-4 and E-5 paygrades that are already simulated to fall short of EPA. The reallocation of accessions between 4YO and AM enlistments takes the distribution across ratings within each enlistment program as fixed. Thus, rating groups that have no 4YO accessions but do have AM accessions end up with higher total accessions in the alternative. Ratings with 4YO but no AM accessions have lower total enlistments with the reallocation. This implicit redistribution of accessions among

ratings means that the observed inventory change is a product of changes in enlistment program mixes and rating mixes. To the extent that the redistribution among ratings yields a different aggregate continuation rate, the magnitude of the estimated inventory change depends on how the new AM accessions have been distributed among ratings. There is no reason to believe that the implicit rating redistribution systematically biases the aggregate inventory prediction up or down. In any event, the accessions could be tailored to any desired combination of ratings and enlistment programs.

TABLE 12

RESULTS OF INCREASING AM ENLISTMENT PROGRAM
BY 3,000 PER YEAR
(FY 1988-FY 1995)

	Base	Redistributed	Difference
FY 1991 inventories			
Active	539,893	538,951	-942
SELRES	103,425	104,449	1,025
FY 1995 inventories			
Active	552,538	550,965	-1,573
SELRES	106,147	108,158	2,011

For the reserves, the shift from 4YO to AM accessions leads to a larger SELRES inventory. This is expected because of the difference in SELRES obligations between the two enlistment programs, and the corresponding difference in affiliation rates. The gain to SELRES inventories is about the same size as the active-duty loss in FY 1991, and is slightly larger by FY 1995. The magnitude of the difference is relatively small because of the high incidence of reenlistment to active duty by AMs.

Alternative 3: Shift of Sea College to 4YO Enlistments

In this experiment, the 3,000 annual Sea College accessions are replaced by 4YO enlistments beginning in FY 1988. Because the Sea College program continuation behavior beyond two years is hypothetical, a sensitivity analysis with respect to this continuation behavior is done. Originally, it is assumed that 10 percent of Sea College accessions enlist into various ratings (table 8). This assumption is changed to a reenlistment rate of 30 percent in an alternative run of the simulation. Replacing two-year enlistments with four-year

enlistments is expected to increase future inventories. If quality of recruits were the same, recruiting costs would be higher for the 4-year enlistments. However, the quality of the 4YO recruits would not be expected to meet the high standards of the Sea College Program, thus providing some offset to the costs of recruiting for a longer term. It is expected that the larger inventories associated with longer enlistment terms come at some cost, either in recruit quality or number of recruits attainable with given recruiting resources. Also, it is not known to what extent Sea College accessions would have enlisted in the Navy in another program (especially the more technical programs).

Table 13 presents the results of alternative 3. Using a 10-percent reenlistment rate, the FY 1991 inventory is simulated to have 5,000 more individuals without the Sea College enlistment program. Increasing the reenlistment rate to 30 percent reduces the difference slightly.

TABLE 13

RESULTS OF REPLACING SEA COLLEGE ACCESSIONS WITH 4YO ACCESSIONS

(FY 1991 inventories)

	Base	10% Sea College reenlistment: Redistributed (no Sea college)	Difference
Active	539,893	545,120	5,227
SELRES[a]	103,425	103,619	194
		30% Sea College reenlistment	
Active	540,383	545,120	4,737
SELRES	103,425	103,619	194

a. The assumption used here is that no Sea College losses affiliate with the SELRES.

Alternative 4: Shift of 3,000 Accessions From 4YO to Prior Service

This alternative involves a substantial percentage increase in the number of prior-service enlistments. Recently, prior-service accessions have been about 6,500 per year, but much higher numbers have been accessed in some years. For example, according to CNRC reports, 9,712

prior-service recruits were accessed in FY 1980, while 12,314 prior-service recruits were accessed in FY 1981. The redistribution of accessions to yield about 9,500 prior-service accessions is not outside the range of observed recruit attainment, and the resulting proportion of prior-service recruits would resemble that of FY 1980.

The results of the shift in accessions are presented in table 14. The FY 1991 active-duty inventory is practically unchanged by 1991. This is to be expected because FY 1988 4YO accessions do not pass the reenlistment point until 1992.

The changes by paygrade are more important, however. The E-1 through E-4 paygrades are reduced by 5,220 while the E-5 through E-7 paygrades are increased by 4,859. The relatively small net loss thus masks a more significant change in the experience mix of enlisted personnel. The shift in the paygrade mix is shown in table 15.

TABLE 14

SIMULATED ACTIVE-DUTY AND SELRES INVENTORIES FOR ALTERNATIVE 4: SHIFT TO PRIOR-SERVICE ACCESSIONS

	Base	Redistributed	Difference
	FY 1991		
Active	539,893	539,534	-359
SELRES	102,737	102,839	102
	FY 1995		
Active	552,538	555,025	2,487
SELRES	102,523	102,662	139

By FY 1995, an active-duty inventory gain of about 2,500 has become evident. The shift in experience mix is even larger (a reduction of 5,670 in E-1 through E-4 and a gain of 8,129 E-5 through E-7).

TABLE 15

SIMULATED PAYGRADE REDISTRIBUTION AND
REQUIREMENTS FOR ALTERNATIVE 3:
SHIFT TO PRIOR-SERVICE ACCESSIONS

	Requirement (EPA)	FY 1991 base	FY 1991 redistributed
E-1 through E-3	167,932	173,005	168,511
E-4	124,826	100,145	99,419
E-5	116,402	105,841	108,883
E-6	94,571	98,283	100,010
E-7	40,230	45,223	45,315
E-8	12,444	12,689	12,690
E-9	5,306	4,707	4,707
Total	561,711	539,893	539,534

IMPROVING THE SIMULATION

The simulation can be improved in at least two ways. First, the tracking of individual behavior could be expanded to gather more information about movements between ratings in each enlistment program. Second, a behavioral component could be added to make reenlistment decisions responsive to policy changes such as SRB multiples, military pay, and sea duty. Of these two possible enhancements, the first is probably more important for the analysis of enlistment programs, and more easily accomplished.

Though behavioral responses to changes in the environment are very important for the aggregate continuation of enlisted personnel, they may not differ substantially between enlistment programs. Increasing military pay or civilian unemployment should induce more individuals to continue on active duty in all enlistment programs, but would only change relative continuation behavior if individuals have been stratified with respect to willingness-to-serve by program of original enlistment. For example, if AM recruits have less taste for service (i.e., would require more compensation on average than 4YO recruits to stay in the service) than other recruits, their continuation on active duty may be less sensitive to pay or unemployment changes than other recruits. However, AM recruits are not expected to continue on active duty beyond three years, (i.e., to reenlist) even though many of those who reach the end of their active-duty obligation do so. The differential behavioral consequences of taste stratification between enlistment programs is an empirical question. The Annualized Cost of Leaving Model (ACOL) simulation of the active-duty enlisted force is designed to incorporate behavioral responses to changing economic conditions thought to affect reenlistment decisions [5]. It does not,

however, contain information specific to enlistment program or reserve affiliation. Pursuing a behavioral forecasting capability is beyond the intended scope of this study.

The results presented in this research memorandum are based on FY 1986 continuation behavior as measured from individual observations. The use of individual data offers more accurate representation of behavior than aggregate data. Continuation behavior from aggregate cell counts by enlistment program, rating group, and LOS is available for the simulation for fiscal years 1981, 1984, and 1985, as well as 1986. It would be desirable to have similar data based on individual observations from these years. This would allow sensitivity analysis with respect to alternative observed continuation rates. Also, it might be desirable to allow users to input non-historical continuation rates of their choosing for use in the simulation. These improvements are feasible.

CONCLUSION

The Total Force Enlistment Programs simulation of Navy enlisted-personnel inventories emphasizes (1) the different continuation behavior of individuals in six different enlistment programs, and (2) the tracking of SELRES affiliation rates by active-duty enlistment program. It indicates the relative magnitude of active-duty and SELRES inventory changes resulting from changes in the total number and composition of enlisted accessions for a period up to ten years in the future. Computations of historical active-duty continuation behavior by enlistment program are based on year-to-year snapshots from the EMR, and on year-to-year snapshots from the IEMF for the reserves. SELRES affiliation rates are computed for Active Mariners and other recent NAVETs separately.

The results available for 69 rating groups should be interpreted with care. In some cases, a rating group may include several individual ratings. Any differences in continuation behavior or relative rating sizes within the group are averaged in the simulation. Furthermore, individual ratings are more volatile than the sum of all ratings. This uncertainty in particular rating sizes reflects planning actions specific to those ratings that are relatively unpredictable. For this reason, the effects of changes in the mix of enlistment programs are more reliable than the effects of changes in the number of accessions into a particular rating group.

Subject to this caution, the simulation is designed to accommodate any desired mix of accessions among enlistment programs and rating groups. Several alternative accession profiles have been examined with the simulation in this paper. Accessions for the base simulation, to which the others are compared, are similar to the number of recent accessions--95,000 per year. The distribution among enlistment programs approximates recent policy, and the distribution of individuals across

rating groups is based on the FY 1988 A-school plan. The simulation uses FY 1986 continuation behavior.

The results indicate that, given historical relations between LOS and paygrade, there will be a mismatch between the paygrade distribution of the EPA and the inventory; the inventory will be too rich in paygrades E-1 through E-3 and E-6 through E-8, and too poor in paygrades E-4 and E-5. This result is consistent with an independent historical simulation [6] that also shows the enlisted force becoming more concentrated in the higher LOS cells in the future. The relation between LOS and paygrade is not altered in the simulation in response to the more senior experience mix. However, promotion propensities are likely to fall reflecting a growing supply of candidates and relatively constant demand. A policy of more selective promotion would tend to redistribute the enlisted inventory by paygrade, but at the cost of lower continuation for those with reduced promotion possibilities.

The results of four alternative accession profiles are compared to the base simulation. Alternative 1 determines the number of accessions beginning in FY 1988 needed to reach the FY 1991 EPA. Approximately 102,000 active-duty accessions per year over this four-year period are required. The resulting enlisted force has a paygrade mismatch similar to the base simulation.

The second alternative shifts 4YO accessions to AM accessions. As expected, this change reduces the active-duty inventory in FY 1991 and increases the SELRES inventory. The inventory loss amounts to about 1,000 in FY 1991 and about 1,600 in FY 1995. These losses are concentrated in the E-4 and E-5 paygrades. The SELRES gains are similar in magnitude. The advantage to active-duty manpower of an accession profile with more AMs is that recruiting costs are probably lower for this program than the 4YO enlistment program. A comparison of the costs and benefits of these changes is beyond the scope of this study, and involves tradeoffs that are analytically intractable.

Alternative 3 examines the effect on active-duty inventories of replacing current Navy Sea College accessions with 4YO GENDET accessions beginning in FY 1988. The change in the FY 1991 inventory depends on what assumptions are made about the unobserved reenlistment rates of Navy Sea College enlistments. Even at a 30-percent reenlistment rate into selected ratings, there is a significant increase in the FY 1991 inventory associated with replacing Navy Sea College enlistments with 4YO enlistments. This assumes that Navy Sea College recruits continue (like the average 4YO recruit) in these ratings once they reenlist, which probably understates their continuation.

The last alternative accession profile considered shifts in accessions from 4YO to prior-service beginning in FY 1988. This is expected to increase the size and experience profile of the inventory. By FY 1995, the simulated inventory has grown by about 2,500 and the

shortage of E-4 and E-5 inventories has significantly worsened, while the E-6 through E-8 inventories have an even greater excess of peresonnel.

These examples indicate some of the uses of the simulation. It may also be used to examine accession requirements under other continuation scenarios, other combinations of shifts between active-duty enlistment programs, changes in SELRES SAM accessions, and new enlistment programs with hypothesized behavior. The simulation can be used to examine alternative accession scenarios as issues regarding the size and mix of active and SELRES enlistment programs arise.

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1. The number in parentheses is an CNA internal control number.